CLAIM AMENDMENTS

This listing of claims will replace all prior versions, and listings, of claims in the application.

1. (Currently Amended) A method of determining whether a multi-component target system meets a given multi-part performability requirement, the method comprising:

obtaining a description of the target system and failure probabilities for components of the target system that can fail independently,

obtaining a multi-part performability requirement for the target system, the multi-part performability requirement indicating desired performance levels for the target system and corresponding fractions of time,

~~operating on a representation of the target system, providing~~ producing a first failure-scenario ~~analysis~~ of said target system using a computer-implemented failure scenario generator module that receives as input the target system description and the failure probabilities, the first failure-scenario comprising one or more states of the target system having zero or more components failed and a corresponding probability of occurrence of the one or more of the states of the target system,

modeling performance of the target system under the first failure scenario using a computer-implemented performance predictor module for generating a multi-part performability function of said target system, the performance predictor module receiving as input ~~using~~ said first failure-scenario ~~analysis~~,

comparing said multi-part performability function with said multi-part performability requirement, and

determining from said comparing whether said target system meets said multi-part performability requirement.

2. (Currently Amended) The method as set forth in claim 1, the step of comparing further comprising:

calculating if said first failure-scenario ~~analysis~~ provides sufficient data for generating a multi-part performability function determinative of target system performance capability when compared to said multi-part performability requirements, and

if so, proceeding with said step of determining, or

if not~~, providing a second failure-scenario analysis of said target system; and~~

~~———~~repeating said steps of producing, generating, comparing, and calculating for successive next failure-scenarios until ~~a next failure-scenario analysis provides~~ sufficient data is obtained for generating a multi-part performability function ~~determining~~ determinative of said target system performance capability when compared to said multi-part performability requirements.

3. (Currently Amended) The method as set forth in claim 1, ~~wherein~~ said performance predictor module also receiving as input a workload description ~~multi-part performability requirements are represented as one or more performance levels versus percentage of time at each of said performance levels~~.

4. (Cancelled)

5. (Currently Amended) The method as set forth in claim 1, the step of producing ~~operating on a representation of the target system~~ comprising:

synthesizing a model of the target system based on predetermined individual components of the target system wherein each of said components has a characteristic failure specification.

6. (Currently Amended) The method as set forth in claim 5, further comprising the steps of:

combining ~~one or more said~~ components of the target system as a macro-component;

computing the failure probability of the macro-component as a function of the failure probabilities of its respective ~~one or more~~ components; and

using macro-components in said computing ~~failure-scenario analysis~~.

7. (Currently Amended) The method as set forth in claim 1, wherein the step of producing is performed ~~providing a first failure-scenario analysis of said target system comprises performing a failure-scenario analysis~~ in accordance with the following ~~further steps of~~:

let "FP(c)" denote a probability that a system component "c" of the target system will fail; then,

(1) Let "D" represent a failure-free system;

(2) Let "c_1, c_2. . .c_{mf} be components that can fail independently in D;

(3) Let "sf" be the number of concurrent failures being considered in the last invocation (initially 0);

(4) Let "s" be the ordinal number, among the scenarios with exactly "sf" failures, of the scenario returned in the last invocation (initially 0);

(5) If there exist exactly "s" scenarios with "sf" concurrent failures, then sf = sf+l; s = 0;

(6) If sf $\leq$ mf, then s = s+l, otherwise exit;

(7) choose a_1, a_2. . .a_{sf} (where a_i, i=l, . . . sf are different integers between 1 and mf) such that there are exactly "s-1" scenarios with "sf" concurrent failures more likely to occur than c_{a1}, c_{a2}. . .c_{asf};

(8) set sc = D with components c_{a1}, c_{a2}. . .c_{asf} marked as failed;

(9) set p = FP(c_{a1}) x FP(c_{a2}) x . . . x FP($c_{a(sf)}$) x (1-FP(c_{bl})) x . . .x (1-FB($c_{b(mf-sf)}$)), where c_{bl},. . .$C_{b(mf-sf)}$ are all the components that did not fail in "sc"; and

(10) return (sc,p).

8. (Currently Amended) The method as set forth in claim [[1]] 2, ~~the step of providing a first failure-scenario analysis of said target system~~ further comprising:

~~eliminating analysis of all failure-scenarios~~ grouping states together wherein said target system is non-functional ~~in accordance with said multi-part performability requirement~~, and

representing the grouped states in the multi-part performability function ~~eliminating analysis of all failure scenarios wherein said target system is fully functional in accordance with said multi-part performability requirement~~.

9. (Currently Amended) The method as set forth in claim [[8]] 2, ~~the step of generating a multi-part performability function comprising further steps of~~ further comprising:

grouping states together wherein the target system is fully functional ~~entering a multi-part performability function indicative of all failure scenarios wherein said target system is non-functional~~; and

representing the grouped states in the multi-part performability function ~~entering a multi-part performability function indicative of all failure scenarios wherein said target system is fully functional in accordance with said multi-part performability requirements~~.

10. (Currently Amended) The method as set forth in claim [[1]] 2, ~~the step of providing a first failure scenario analysis of said target system comprising:~~

~~———~~wherein the failure-scenarios are computed ~~repetitively entered based on~~ according to an order of likelihood of occurrence ~~beginning with a most likely failure scenario~~.

11. (Currently Amended) The method as set forth in claim 10, comprising ~~the steps of~~:

if a multiplicity of like components having like failure probability and effect are employed within said target system, treating said multiplicity of like components as a single component of said target system.

12. (Cancelled)

13. (Currently Amended) The method as set forth in claim [[12]] 2, wherein repeating the steps of producing, generating, comparing, and calculating for successive next failure-scenarios is performed in accordance with the following ~~the step of verifying the equation further comprising~~:

(1) set i = 1;

(2) generate the next state S_i and its occurrence probability $OP(S_i)$~~, from said step of generating the next failure scenario~~;

(3) compute the performance $U(S_i)$ using [[a]] the performance predictor module; and

(4) if,

$$\sum_{k=1}^{i} OP(S_k)\, 1(U(S_k) \geq r_j) \geq f_j, \text{ for all } j=1,2,\ldots n,$$

then the target system is capable of fulfilling the multi-part performability requirements, exit and report; or

(5) if,

$$\sum_{k=1}^{i} OP(S_k)\, 1(U(S_k) < r_j) \geq 1-f_j, \text{ for any } j=1,2,\ldots n,$$

then the target system fails the multi-part performability requirements, exit and report; and otherwise,

(6) set i = i +1 and go to step (2).

14. (Currently Amended) A computer readable media comprising computer code for implementing a method of determining whether a multi-component target system meets a given multi-part performability requirement, the method comprising the steps of ~~A computer memory comprising~~:

~~computer code operating on a representation of the target system, providing~~ producing a first failure-scenario ~~analysis~~ of said target system, the first failure-scenario comprising one or more states of the target system having zero or more components failed and a corresponding probability of occurrence of the one or more of the states of the target system;

~~computer code providing a first failure-scenario analysis of said target system;~~

~~computer code~~ modeling performance of the target system under the first failure scenario for generating a multi-part performability function ~~using said first failure-scenario analysis~~;

~~computer code~~ comparing said multi-part performability function with said multipart performability requirements; and

~~computer code~~ determining from said comparing whether said target system has a capability of performing said multi-part performability requirements.

15. (Currently Amended) The ~~memory~~ media as set forth in claim 14, ~~the computer code comparing~~ further comprising computer code for:

calculating if said first failure-scenario ~~analysis~~ provides sufficient data for generating a multi-part performability first function determinative of predicting multi-part performability when compared to said multi-part performability requirements, and

if so, proceeding with said step of determining; or

if not,

repeating the steps of producing, generating, comparing, and calculating for successive next failure-scenarios until sufficient data is obtained for generating a multi-part performability function determinative of the target system performance capability when compared to the multi-part performability requirements

~~providing a second failure-scenario analysis of said target system;~~

~~repeating said steps of computing by generating a multi-part performability next function;~~

~~comparing said next function with said multi-part performability requirement; and~~

~~calculating until a next failure-scenario analysis provides sufficient data for generating a multi-part performability second function determinative of predicting multi-part performability of said system when compared to said multi-part performability requirements~~.

16. (Currently Amended) The ~~memory~~ media as set forth in claim 15, ~~the computer code providing a first failure-scenario analysis of said target system~~ further comprising computer code for:

~~eliminating all failure-scenarios~~ grouping states together wherein said target system is non-functional; and

~~eliminating all failure scenarios~~ grouping states together wherein said target system is fully functional in accordance with said performance requirements.

17. (Currently Amended) The ~~memory~~ media as set forth in claim 16, ~~the code providing a first failure-scenario analysis of said target system further comprising:~~ ~~——~~wherein failure-scenarios are computed ~~repetitively entered based on~~ according to an order of likelihood of occurrence ~~beginning with a most likely failure-scenario~~.

18. (Cancelled)

19. (Cancelled)

20. (Cancelled)

21. (Cancelled)

22. (New) A computer system for determining whether a multi-component target system meets a given multi-part performability requirement, comprising:

a failure scenario generator module for producing a first failure-scenario of the target system from a description of the target system and failure probabilities for components of the target system that can fail independently, the first failure-scenario comprising one or more states of the target system having zero or more components failed and a corresponding probability of occurrence of the one or more of the states of the target system,

a performance predictor module for modeling performance of the target system under the first failure scenario wherein a multi-part performability function of the target system is generated from the performance predicted for the target system, the performance predictor module receiving as input the first failure-scenario, and

a performability evaluator module for comparing the multi-part performability function with a multi-part performability requirement for the target system, the multi-part performability requirement indicating desired performance levels for the target system

and corresponding fractions of time, and for determining from the comparison whether the target system meets the multi-part performability requirement.

23. (New) The computer system as set forth in claim 22, wherein the performability evaluator module determines whether the first failure-scenario provides sufficient data for generation of a multi-part performability function determinative of target system performance capability when compared to the multi-part performability requirements, and

if so, the performability evaluator module proceeds with determining from the comparison whether the target system meets the multi-part performability requirement, or

if not, successive next failure-scenarios are evaluated until sufficient data is obtained for generating a multi-part performability function determinative of the target system performance capability when compared to the multi-part performability requirements.

24. (New) The computer system as set forth in claim 22, wherein the performance predictor module also receives as input a workload description.

25. (New) The computer system as set forth in claim 22, wherein the performance predictor synthesizes a model of the target system based on predetermined individual components of the target system wherein each of said components has a characteristic failure specification.

26. (New) The computer system as set forth in claim 22, wherein components of the target system are combined as a macro-component and the failure probability of the macro-component is computed as a function of the failure probabilities of its respective components.

27. (New) The computer system as set forth in claim 22, wherein the failure scenario generator operates in accordance with the following:

let "FP(c)" denote a probability that a system component "c" of the target system

will fail; then,

(1) Let "D" represent a failure-free system;

(2) Let "c_1, c_2. . .c_{mf} be components that can fail independently in D;

(3) Let "sf" be the number of concurrent failures being considered in the last invocation (initially 0);

(4) Let "s" be the ordinal number, among the scenarios with exactly "sf" failures, of the scenario returned in the last invocation (initially 0);

(5) If there exist exactly "s" scenarios with "sf" concurrent failures, then sf = sf+l; s = 0;

(6) If sf $\leq$ mf, then s = s+l, otherwise exit;

(7) choose a_1, a_2. . .a_{sf} (where a_i, i=l, . . . sf are different integers between 1 and mf) such that there are exactly "s-1" scenarios with "sf" concurrent failures more likely to occur than c_{a1}, c_{a2}. . .c_{asf};

(8) set sc = D with components c_{a1}, c_{a2}. . .c_{asf} marked as failed;

(9) set p = FP(c_{a1}) x FP(c_{a2}) x . . . x FP($c_{a(sf)}$) x (1-FP(c_{b1})) x . . .x (1-FB($c_{b(mf-sf)}$)), where c_{b1},. . .$C_{b(mf-sf)}$ are all the components that did not fail in "sc"; and

(10) return (sc,p).

28. (New) The computer system as set forth in claim 22, wherein states are grouped together in which the target system is non-functional, and the grouped states are represented in the multi-part performability function.

29. (New) The computer system as set forth in claim 22, wherein states are grouped together in which the target system is fully functional, and the grouped states are represented in the multi-part performability function.

30. (New) The computer system as set forth in claim 22, wherein the failure-scenarios are computed according to an order of likelihood of occurrence.

31. (New) The computer system as set forth in claim 30, wherein if a multiplicity of like components having like failure probability and effect are employed within the target system, the multiplicity of like components are treated as a single component of the target system.

32. (New) The computer system as set forth in claim 22, wherein the computer system operates in accordance with the following:

(1) set $i = 1$;

(2) generate the next state S_i and its occurrence probability $OP(S_i)$;

(3) compute the performance $U(S_i)$ using the performance predictor module; and

(4) if,

$$\sum_{k=1}^{i} OP(S_k)\ 1(U(S_k) \geq r_j) \geq f_j, \text{ for all } j=1,2,\ldots n,$$

then the target system is capable of fulfilling the multi-part performability requirements, exit and report; or

(5) if,

$$\sum_{k=1}^{i} OP(S_k)\ 1(U(S_k) < r_j) \geq 1-f_j, \text{ for any } j=1,2,\ldots n,$$

then the target system fails the multi-part performability requirements, exit and report; and otherwise,

(6) set $i = i + 1$ and go to step (2).